Application Manual

Flexible Disk Storage Drive
3.5 INCH
(25.4 mm Height)
(DC 5V only)

JU-257Axx6P

(MLC 6 of JU-257A Series)

Revision "L"

Panasonic

JU-257AXX6P(L)   REVISION CONTROL SHEET

Revision	Date	Note
05680A4	May. 12 '97	1st Edition

CONTENTS

SECTION I
INTRODUCTION

1.1   GENERAL DESCRIPTION

Model JU-257A6P is 3.5 inch double - sided flexible disk storage drive,   provided for MLC-6 of JU-257A series.

JU-257A6P offers same features as JU-257 series; 2.0 Mbytes unformatted storage capacity, 3 ms track-to-track accessing, 300 rpm of rotational speed, only +5V dc power for operation, and backwards capability to read/write the diskette written on a standard 1.0 Mbyte diskette.

When the JU-257A6P is using a normal density diskette (2DD), it works as a standard 1.0 Mbyte drive. With a high density diskette (2HD), the JU-257A6P becomes a 2.0 Mbyte drive.

In addition, the JU-257A6P provides precise access mechanism, high performance 1 - chip LSI, TTL interface, compact direct drive spindle motor, and lower heat dissipation along with improved reliability.

Key Features :
◇ Physical size : 101.6×150×25.4 mm (W×D×H)
◇ Weight : 390 g
◇ Precise screw / follower actuator.
◇ 1 - chip (control logic and R/W) LSI.
◇ Compact DD spindle motor.
◇ Lower power consumption and TTL interface.
◇ 3.5 inch FDD standard interface connector. (34 pins)
◇ Single - sided PCB

1.2   SPECIFICATIONS SUMMARY

1.2.1   Performance Specifications

	High Density Mode	Normal Density Mode
Capacity (in bytes)		
Unformatted (MFM)		
Per Disk	2,000,000	1,000,000
Per Surface	1,000,000	500,000
Per Track	12,500	6,250
Formatted (MFM)	18 sectors / track	9 sectors / track
Per Disk	1,474,560	737,280
Per Surface	737,280	368,640
Per Track	9,216	4,608
Per Sector	512	512
Transfer Rate (MFM)	500 kbits / s	250 kbits / s
Access Time		
Track to Track	3 ms	3 ms
Settling Time	15 ms	15 ms
Average	79 ms	79 ms
Latency (avg.)	100 ms	100 ms
Turn Around Delay (min.)	18 ms	18 ms

1.2.2 Functional Specifications

	High Density	Normal Density
Motor Start Time (max.)	500 ms	500 ms
Rotational Speed	300 rpm	300 rpm
Recording Density (MFM) (inner most track)	17, 434 bpi	8, 717 bpi
Track Density	135.467 tpi	135.467 tpi
Cylinders	80	80
Tracks	160	160
Read / Write Heads	2	2

1.2.3 Reliability Specifications

MTBF	30, 000 POH under typical usage
MTTR	30 minutes
Component Life	15, 000 POH or 5 years
Error Rates	
Soft Read Errors	1 per 10^9 bits read
Hard Read Errors	1 per 10^{12} bits read
Seek Errors	1 per 10^6 seeks
Durability	
Diskette Insertion / Ejection	30, 000 times
Seek	10×10^7 seeks
Media Wear	3.5×10^6 passes

1.2.4 Physical Specifications

	Operating	Non - Operating
Environmental Limits		
Ambient Temperature	5 to 45°C (41 to 113°F)	−40 to 60°C (−40 to 140°F)
Maximum Temperature Gradient	20°C (36°F) / H	20°C (36°F) / H
Relative Humidity (non-condensing)	20 to 80 % RH	5 to 90% RH
Maximum Wet Bulb Temperature	29°C (84.2°F)	29°C (84.2°F)
Vibration (except resonant point)	5.88m/s^2(0.6G) 5 to 500 Hz	19.6m/s^2(2G) 10 to 500 Hz
Shock (half sine wave)	49m/s^2(5G) / 11ms	588m/s^2(60G) / 11ms

DC Power Requirements   : +5V ± 10%, 0.29A (typ)/0.71A (max)/0.9A (peak), 100mV p-p ripple
Power Dissipation   : 1.5 W under continuous typical, 20 mW under standby*
* standby : Drive select off, drive motor off, and step motor off.

Mechanical Dimension	
Width	101.6 mm
Height	25.4 mm
Depth	150 mm Including front bezel
Weight	390 g
Mounting Inclination Limits	0 to 20 deg mounted vertical / horizontal
Diskette Operating Force	800 g for inserting, 1,500 g for ejecting
Acoustic Noise	45 dBA - fast at 1 meter from drive at 3ms seeking

1.2.5 Power Requirements

Item				Rating	
Power requirement	Voltage			5V ± 10% Max Ripple 100 mVp-p	
	Current	When operating	Seek	0.55A (max) 0.45A (typ)	
			Read	0.35A (max) 0.29A (typ)	
			Write	0.35A (max) 0.29A (typ)	
			At motor start	0.71A (max) 0.64A (typ)	
	Power consumption	At motor start		3.9W (max) 3.2W (typ)	
		Seek		3.0W (max) 2.3W (typ)	
		Read		1.9W (max) 1.5W (typ)	
		Write		1.9W (max) 1.5W (typ)	
		Stand by		28mW (max) 20mW (typ)	

Note :   "Stand by mode" states all input signals "off".

Note :   1.   At motor start: Up to 250 ms after motor start
           2.   Seek: For seeking after 250 ms subsequent to motor start
           3.   Power requirements represent the values in the case when a diskette with a load of 35 g - cm is used.
           4.   Peak current values are specified in figure 1 - 1.
           5.   Max / Typ : When +5V +10% / ±0% at DC power connector J2.
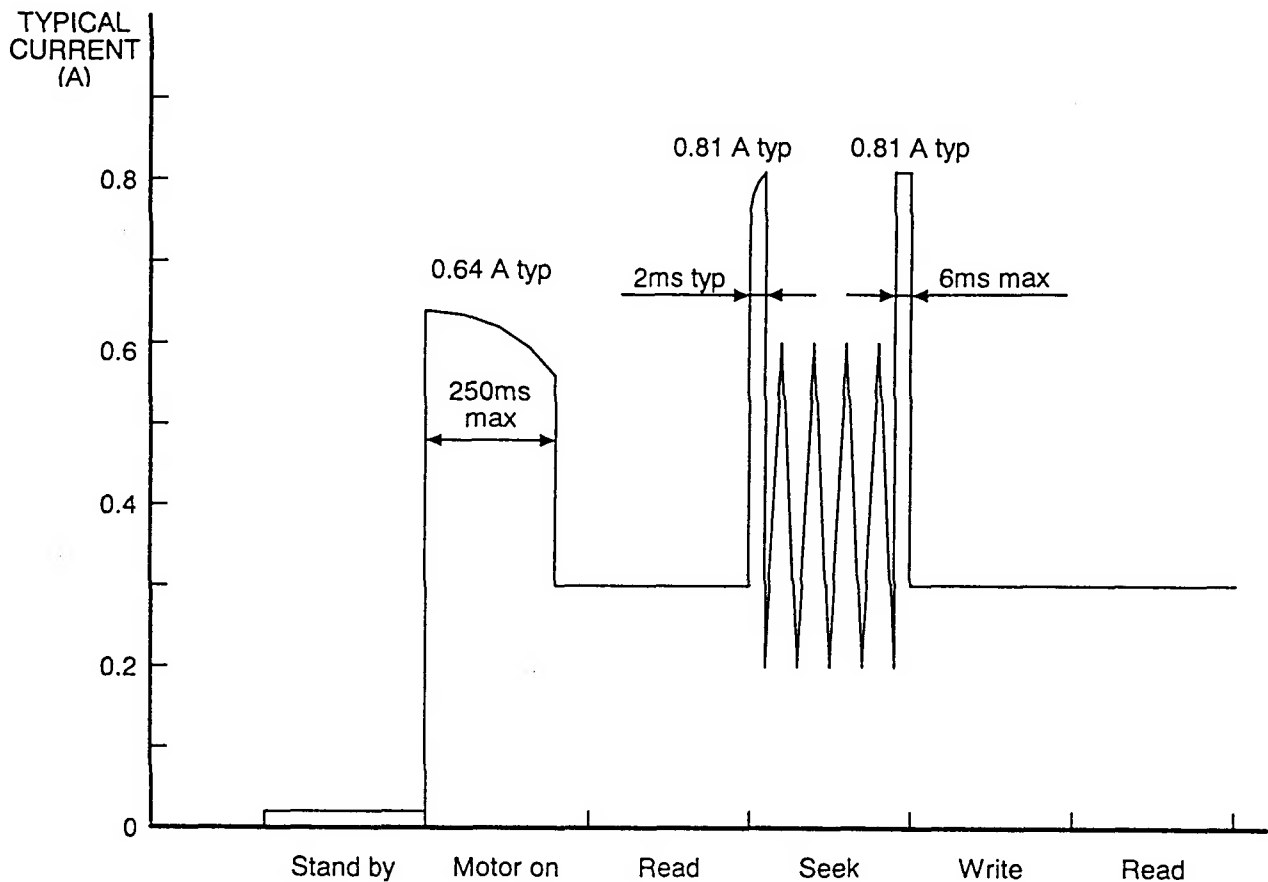
FIGURE 1-1   DC POWER PROFILE

Note : High power consumption is required against the motor-start after start-up of Spindle motor during the 250 ms.
When "Step Mode" has been used during the 250 ms from motor-start, the power consumption will rise to a peak which will cause the DC power supply heavy.
To prevent the load, it is recommended not to use the Step Mode during 250 ms after the motor-start.   It is required to use the motor-start after 18 ms from STEP signal.

1.2.6   Diskette Requirements

Use recommended diskette.   (High density For 2.0MB Recording)
(Normal density For 1.0MB Recording)

1.3 CHARACTERISTICS

1.3.1 Time Margin (TM)

In the case of FM, a random pattern or a repetitive pattern of 11100101 = (E5).
In the case of MFM, a random pattern or a repetitive pattern of 1011011011011011 = (B6DB).
The time margin on reading or writing of the above pattern satisfies the following specification values.

Self read / write   :   TM $\geqq$ 0.15 τ
Compatible read / write   :   TM $\geqq$ 0.10 τ
τ is the clock-to-clock interval,   8 μs for FM and 4 μs for MFM at 1.0M Mode,
                                            4 μs for FM and 2 μs for MFM at 2.0M Mode.

1.3.2 Positioning Accuracy

RN = 39.5 - 0.1875N $\pm$0.025 (mm)   (side 0)
RN = 38.0 - 0.1875N $\pm$0.025 (mm)   (side 1)

Where RN=distance from spindle center to the track, and
Measuring conditions : N=40, 23$\pm$2°C, 50$\pm$10%RH

1.3.3 Positional Relation between Index and Head

The time - base error of the positional relation between read / write head and index signal detector is not greater than 1600μs between drives.

1.3.4 Precompensation

The recommended write data Precompensation values are 100~150 ns (2.0M - MODE) and 100~250 ns (1.0M - MODE), for all tracks.

1.4 INTERFACE SIGNAL

1.4.1 Signal Level

Signals exchanged between the controller and drive are all at TTL levels (low true).

	High	Low
Output level	2.4 V minimum	0.4 V maximum
Input level	2.2 V minimum	0.8 V maximum

Input impedance : 1kΩ   Output sink current : 48mA

1.5 FUNCTIONAL CONSTRUCTION

The JU-257A6P drives consist of :

    a. Read / Write and Control Electronics
    b. Drive Mechanism
    c. Precision Track Positioning Mechanism
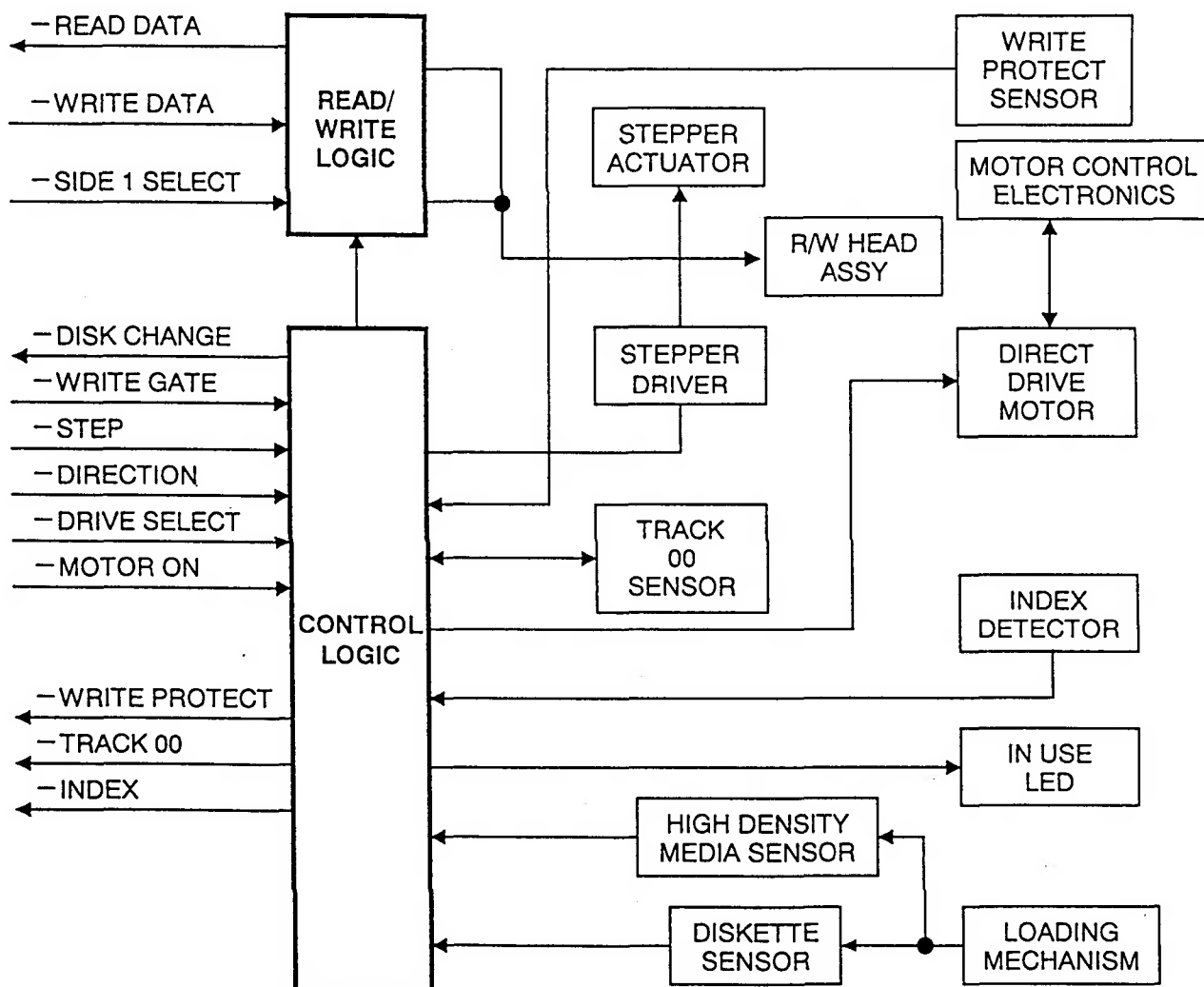   d. Read/Write Heads

FIGURE 1-2   JU-257A6P BLOCK DIAGRAM

1.5.1 Read/Write and Control Electronics

The main PCB contains the following :

    a. Head Positioning Actuator Driver
    b. Read/Write Amplifier and Transition Detector
    c. Drive Select Circuit
    d. Control Logic Circuit
    e. Side Select Circuit

and the Spindle Motor PCB contains the following :

    f. Index Detector Circuit
    g. Write Protect Circuit
    h. Spindle Motor Drive and Control Circuits

The Head Positioning Actuator moves the read/write heads to the desired track on the disk. The disk is loaded on to the read/write heads by an elevator mechanism when the diskette is inserted.

1.5.2 Drive Mechanism

The DC drive motor under servo speed control (using an integral tachometer) rotates the spindle at 300 rpm through a direct-drive system. A magnetic chucking device in conjunction with a metallic hub on the diskette provides precise diskette positioning to ensure data interchange. The motor control electronics are contained as part of the spindle motor assembly.

1.5.3 Precise Track Positioning Mechanism

The read/write head assembly is accurately positioned through the use of a lead screw which is attached to the head carriage assembly. Precise track location is accomplished by a precise stepping motor.

1.5.4 Read/Write heads

The specially-bonded ceramic and ferrite read/write heads contain erase elements to provide erased areas between data tracks. Thus, normal interchange tolerances between diskette and drives will not degrade the signal-to-noise ratio and diskette interchangeability is ensured.

The read/write heads are mounted on a carriage which is located on a precise carriage assembly. The diskette is held in a plane perpendicular to the read/write heads by pins located on the base casting. This precise registration assures perfect compliance with the read/write heads. The read/write heads are in direct contact with the disk. The head surfaces have been designed to obtain maximum signal transfer to and from the magnetic surface of the disk with minimum head/diskette wear.

1.5.5 Recording Formats

The format of the data recorded on the disk is totally a function of the host system. This format can be designed around the user's application to take maximum advantage of the total available bits that can be written on any one track.

For detailed discussion of the various recording formats, refer to Section VI.

1.6 GENERAL DESCRIPTION

The JU-257A6P has been listed with Underwriters Laboratories, Inc., and the Canadian Standards Association.

SECTION II
ELECTRICAL INTERFACE AND TIMING SPECIFICATIONS

2.1   INTRODUCTION

The interface of the JU - 257A6P can be divided into two categories:
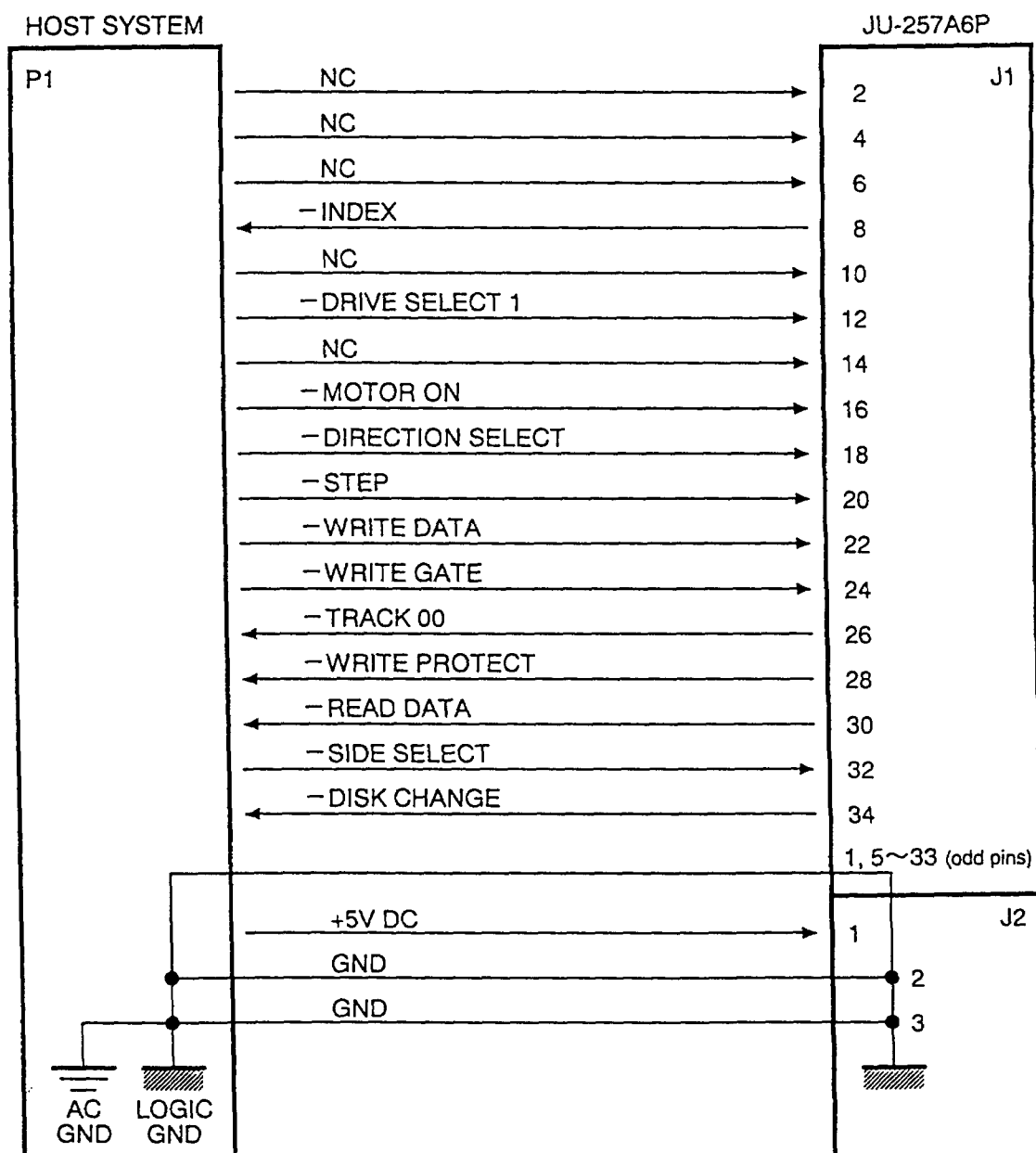   a. Signal Interface   b. Power Interface

The following provides the electrical definition for each line. See figure 2-1 for all interface connections.

2.2   SIGNAL INTERFACE

The signal interface consists of two categories:
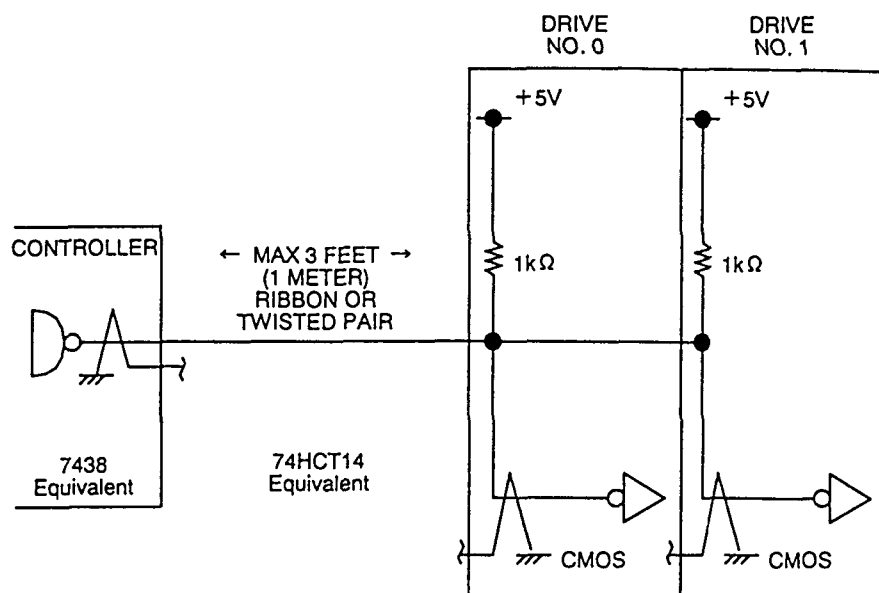   a. Control Lines   b. Data Transfer Lines

All lines in the signal interface are digital in nature and provide signals to the drive (input) or to the host (output) via interface connector P1/J1.

HOST SYSTEM

JU-257A6P

P1		J1
	NC →	2
	NC →	4
	NC →	6
	← – INDEX	8
	NC →	10
	– DRIVE SELECT 1 →	12
	NC →	14
	– MOTOR ON →	16
	– DIRECTION SELECT →	18
	– STEP →	20
	– WRITE DATA →	22
	– WRITE GATE →	24
	← – TRACK 00	26
	← – WRITE PROTECT	28
	← – READ DATA	30
	– SIDE SELECT →	32
	← – DISK CHANGE	34

1, 5~33 (odd pins)

		J2
	+5V DC →	1
	GND	2
	GND	3

AC GND   LOGIC GND

Note J1/pin3, J2/pin4 : NC

FIGURE 2-1 INTERFACE CONNECTION

1) Receiving

Note 1 : Be sure to change the terminal resistance as follows when many units are connected.
Two units : 500 Ω

Note 2 : The level of the signal line is not assured if power of any drive has been switched off.
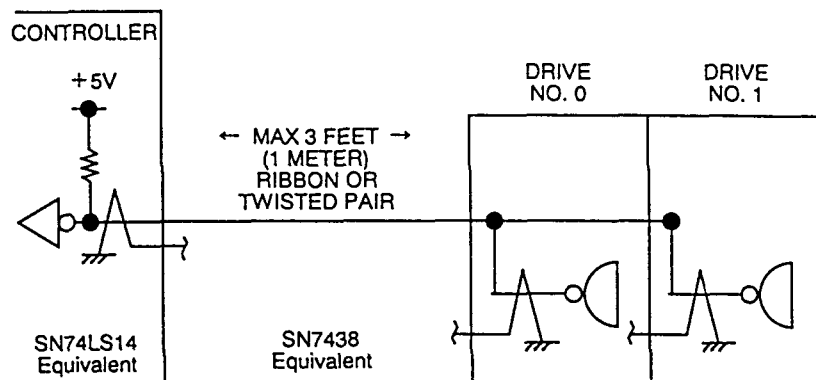
2) Transmitting

FIGURE 2-2   INTERFACE SIGNAL DRIVER / RECEIVER

2.3 Input Lines

The input lines have the following electrical specifications. See figure 2-2 for the recommended circuit.

True = Logical zero = Vin +0.0 to 0.8V @ Iin = 6 mA (max.)
False = Logical one = Vin +2.2 to +5.25V @ Iin = 250 μA (open)
Input impedance = 1 kΩ

2.3.1 Input Line Termination

The JU-257A6P has been provided with the capability of terminating the eight input lines listed below.

a. −DRIVE SELECT 1   e. −SIDE 1 SELECT
b. −MOTOR ON   f. −WRITE GATE
c. −DIRECTION SELECT   g. −WRITE DATA
d. −STEP

These lines are terminated through a 1 kΩ resistor which is built - in the 1 chip LSI.

In a single drive system, this resistor provides 1kΩ input impedance for input lines. In a multiple (two) drive system, the input impedance is varied to 500Ω.

2.3.2 −Drive Select 1

Logical zero on the interface selects a desired drive to enable all other signal lines (except −MOTOR ON).

The ACTIVITY LED on the selected drive will turn on when the corresponding DRIVE SELECT signal is active.
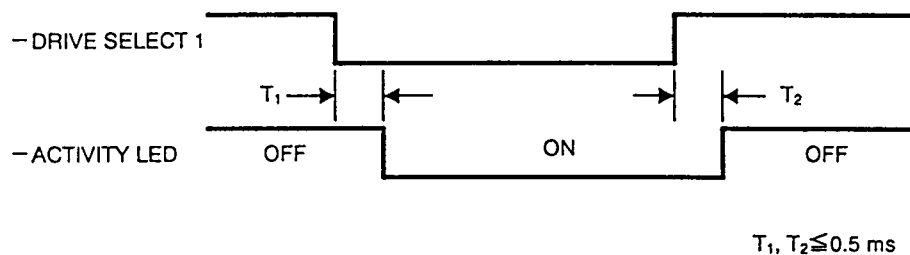

T_1, $T_2 \leqq 0.5$ ms

FIGURE 2-3   IN USE TIMING

2.3.3 −Motor ON

This input, when activated to a logical zero level, will turn on the drive motor allowing reading or writing on the drive. 500 ms delay after activating this line must be allowed before reading or writing.
All motors in a daisy chain configuration are activated by −MOTOR ON.

2.3.4 −Direction Select

This interface line defines the direction of motion the read/write heads will take when the −STEP line is pulsed. An open circuit, or logical one, defines the direction as "out". If a pulse is applied to the −STEP line, the read/write heads will move away from the center of the disk. Conversely, if this input is shorted to ground or a logical zero level, the direction of motion is defined as "in". If a pulse is applied to the −STEP line, the read/write heads will move towards the center of the disk.

2.3.5 −Step

This interface line is a control signal which causes the read/write heads to move in the direction of motion defined by the −DIRECTION SELECT line. This signal must be a logical zero-going pulse with a minimum pulse width of 1 μs. Each subsequent pulse must be delayed by 3 ms (minimum) from the preceding pulse for normal mode.

The access motion is initiated on each logical zero to logical one transition, or at the trailing edge of the signal pulse. Any change in the −DIRECTION SELECT line must be made at least 1 μs before, and must be maintained 1 μs after the trailing edge of the step pulse.

Seeking the read/write heads from one track to another is accomplished by:

   a. Activating the −DRIVE SELECT 1 line
   b. Selecting the desired direction using the −DIRECTION SELECT line
   c. −WRITE GATE being inactive
   d. Pulsing the −STEP line

Multiple track accessing is accomplished by repeated pulsing of the −STEP line until the desired track has been reached. As mentioned above, with the −DIRECTION SELECT line at a plus logic level (2.2 to 5.25V), a pulse on the −STEP line will cause the read/write heads to move one track away for the center of the disk. With the −DIRECTION SELECT line at a minus logic level (0 to 0.8V), a pulse on the −STEP line will cause the read/write heads to move on track closer to the center of the disk. The pulses applied to the −STEP line must have the timing characteristics shown in Figure 2-4, 2-5.
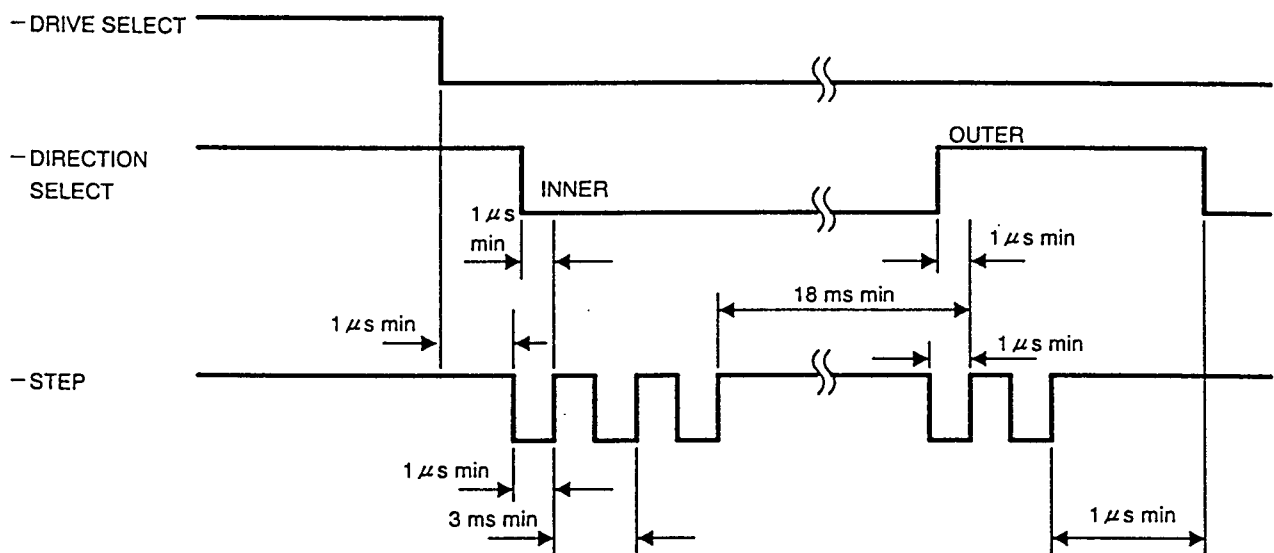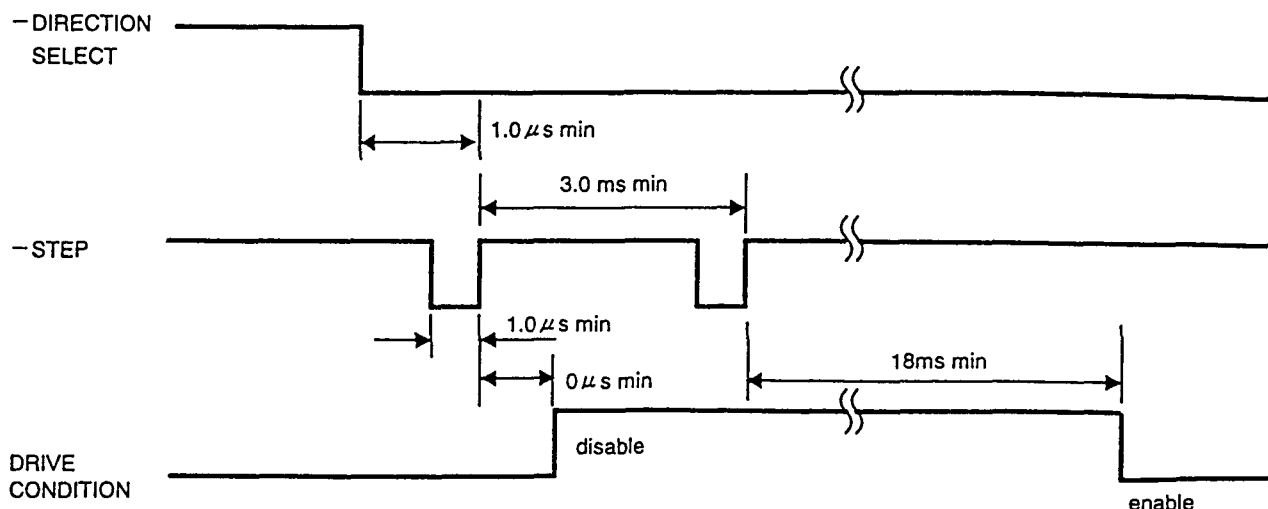

FIGURE 2-4   TRACK ACCESS TIMING

FIGURE 2-5 NORMAL STEP MODE

Note : After seeking, 18 ms (minimum) delay from the trailing edge of the last step pulse is required before any read or write operation can be initiated.

Also, 18 ms (minimum) delay is required before seeking again, after seeking is accomplished, after detecting −TRACK 00 signal, or after changing the direction with −DIRECTION SELECT signal.

2.3.6 −Side 1 Select

This interface line defines which side of a two-sided disk is used for reading or writing. An open circuit, or logical one, selects the read/write heads on the side 0 surface of the disk. A short to ground, or a logical zero, selects the read/write on the side 1 surface of the disk. When switching from one head to the other, a 100 μs delay at 2.0M mode or a 200 μs delay at 1.0M mode is required before any read or write operation can be initiated.

2.3.7 −Write Gate

The active state of this signal or logical zero, enables write data to be written on the disk. The inactive state or logical one, enables the read data logic and stepper logic.

2.3.8 −Write Data

This interface line provides the data to be written on the disk. Each transition from a logical one level to a logical zero level will cause the current through the read/write head to be reversed, thereby writing a data bit. This line is enabled by −WRITE GATE being active.

−WRITE DATA must be inactive during a read operation.

Writing data to the JU-257A6P is accomplished by:

    a. Activating the −DRIVE SELECT line
    b. Activating the −MOTOR ON line
    c. Activating the −WRITE GATE line
    d. Pulsing the −WRITE DATA line with the data to be written

The timing relationships required to initiate a write data sequence are shown in Figure 2-6. These timing specifications are required in order to guarantee that the position of the read/write heads has stabilized prior to writing. The timing specifications for the write data pulses are shown in Figure 2-7. The clock-to-clock interval (τ) is 8 μs for FM and 4 μs for MFM at 1.0M mode, 4 μs for FM and 2 μs for MFM at 2.0M mode.
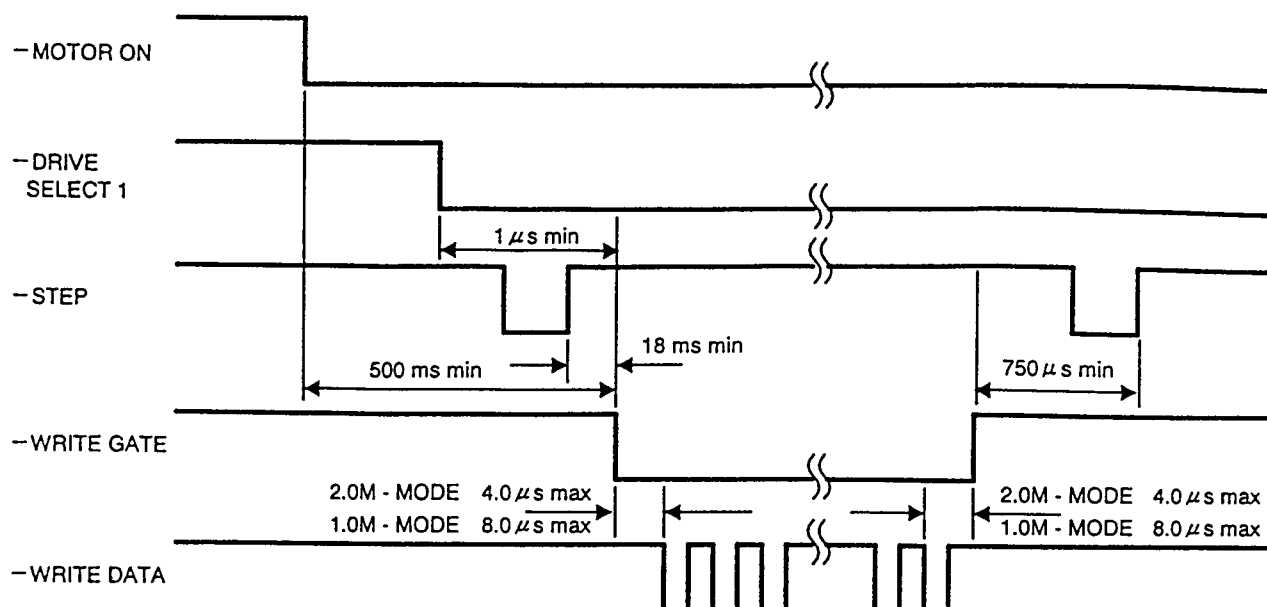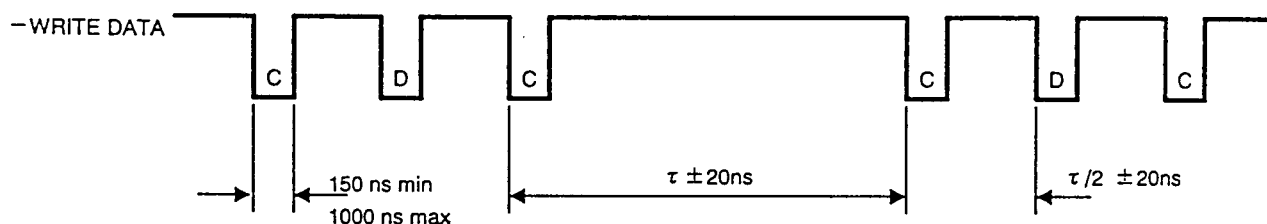
FIGURE 2-6   WRITE INITIATE TIMING

FIGURE 2-7   WRITE DATA TIMING

Write data encoding can be FM or MFM. The recommended write data precompensation values are 100~150n (2.0MB-MODE) and 100~250ns (1.0M-MODE), at all tracks. The direction of compensation required for any given bit in the data stream depends on the pattern it forms with nearby bits.

Note   :   When this signal is activated, 18 ms (minimum) delay is required after the trailing edge of the preceding −STEP pulse, and 100μs (minimum) delay also is required from the changed −SIDE 1 SELECT signal.
After this signal is inactive, 750μs (minimum) delay is required ;
a)   to turn off the drive motor
·b)   to deactivate the −DRIVE SELECT 1 signal
c)   to move the read/write heads with causing the −STEP signal
d)   to change the level of the −SIDE 1 SELECT signal

2-6

2.4   Output Lines

The output control lines have the following electrical specifications. See figure 2-2 for the recommended circuit.

True = Logical zero = Vout +0.0 to +0.4V @ Iout = 48 mA (max.)
False = Logical one = Vout +2.4 to +5.25V (open collector) @ Iout = 250 μA (max.)

2.4.1   — Index

This interface signal is provided by the drive each motor revolution.

There is one pulse on this interface signal per revolution of the disk (200 ms). This pulse indicates the actual start of a track.

When using the — INDEX signal, look for an edge or transition rather than a level for determining the status.
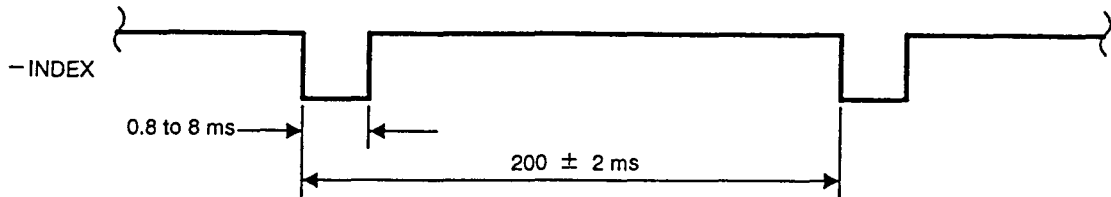
FIGURE 2-8   INDEX TIMING

2.4.2   — Read Data

This interface line provides the "raw data" (clock and data together) as detected by the drive electronics. Normally, this signal is a logical one level and becomes a logical zero level for the active state.

Reading data from the JU - 257A6P is accomplished by:
   a.   Activating — DRIVE SELECT line
   b.   Activating — MOTOR ON line
   c.   WRITE GATE being inactive

The timing relationships required to initiate a read sequence are shown in figure 2-9. These timing specifications are required in order to guarantee that the read/write heads position has stabilized prior to reading.

FIGURE 2-9   READ INITIATE TIMING

2-7

The timing of read data is shown in figure 2-10. The clock-to-clock interval (τ) is 8 μ s for FM and 4 μ s for MFM at 1.0M mode, 4 μ s for FM and 2 μ s for MFM at 2.0M mode.
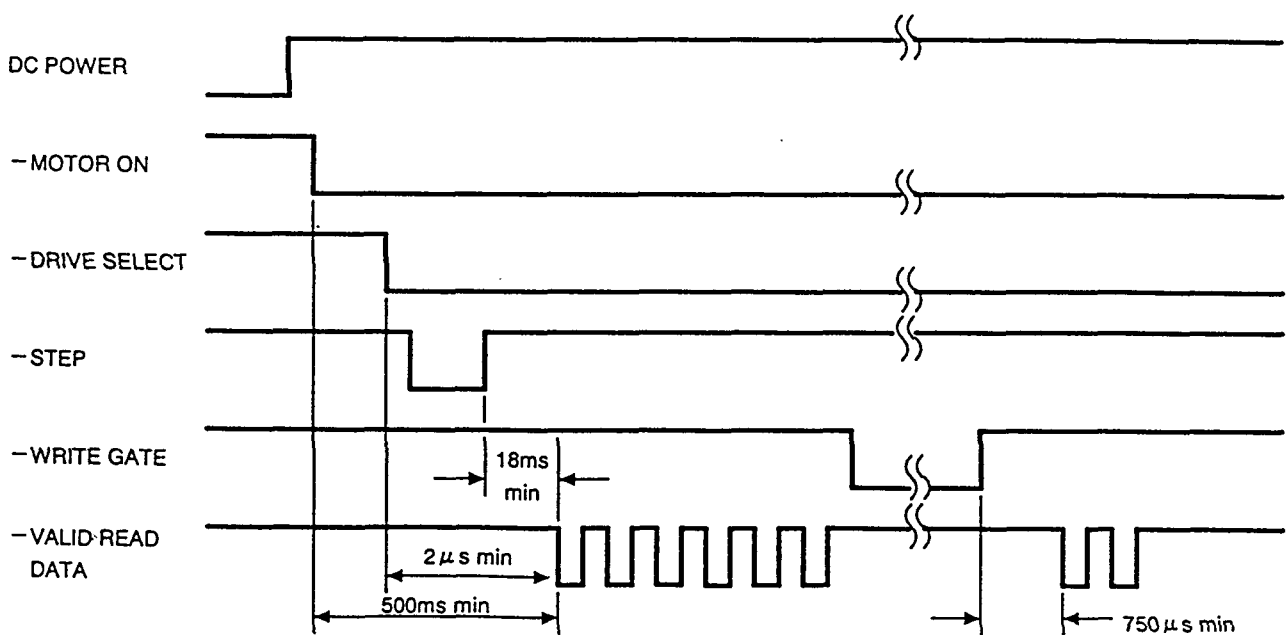
The encoding scheme of the recorded data can be either FM or MFM. FM encoding rules specify a clock bit at the start of every bit cell. MFM encoding rules allow clock bits to be omitted from some bit cells if the preceding bit cell or the current bit cell contains a data or clock bit. See figure 2-11.

In the above-mentioned encoding schemes, clock bits are written at the start of their respective bit cells, and data bits at the centers of their bit cells.
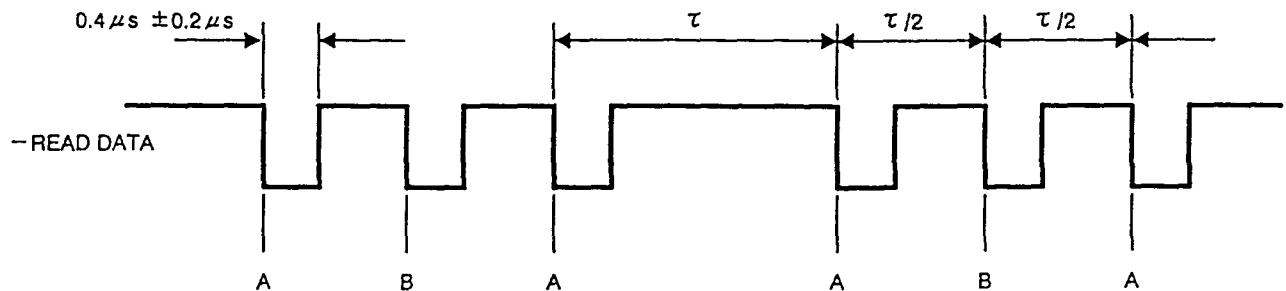
FIGURE 2-10   READ DATA TIMING
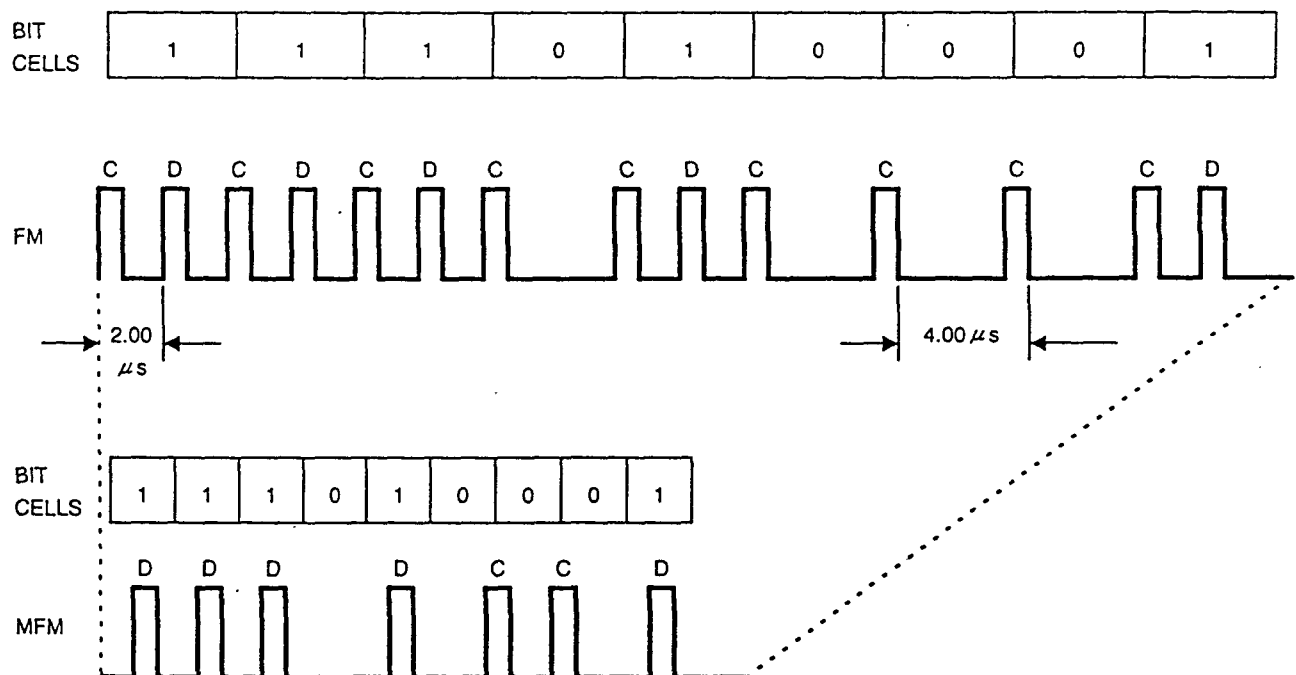
FIGURE 2-11   FM AND MFM CODE COMPARISONS

2.4.3   — Write Protect

This interface signal is provided by the drive to indicate to the user that a write protected diskette is inserted. The signal is logical zero level when it is protected. The drive will inhibit writing with a write - protect diskette inserted and notifies the interface.

2.4.4 — Track 00

The active or logical zero state of this interface signal indicates when the read/write head of the drive is positioned at track zero (the outermost track) and the stepper is locked on track. This signal is at a logical one level, or inactive state, when the read/write head is not at track 00.

Note : This signal is enabled within 2.9 ms after receiving the —STEP signal.
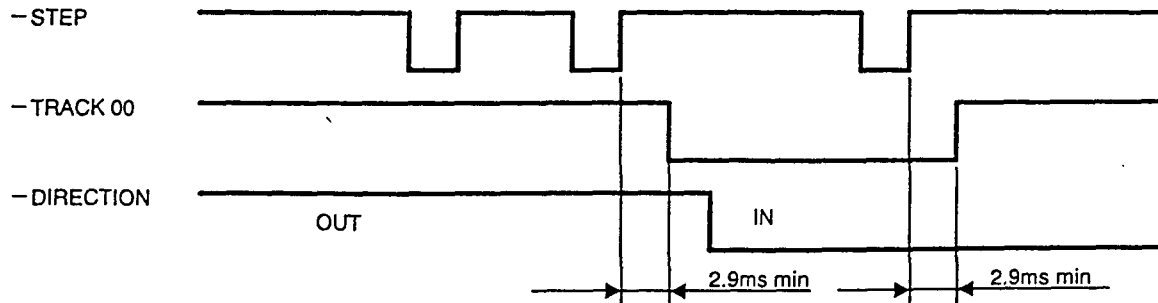

FIGURE 2-12   TRACK 00 TIMING

2.4.5 — Disk Change

This interface signal is provided by the drive to indicate the condition that diskette is ejected and output when —DRIVE SELECT 1 line is activated.

NOTE : When —MOTOR ON signal is active low, 100 ms delay is required after inserting media up to the —STEP signal to reset the —DISK CHANGE signal.
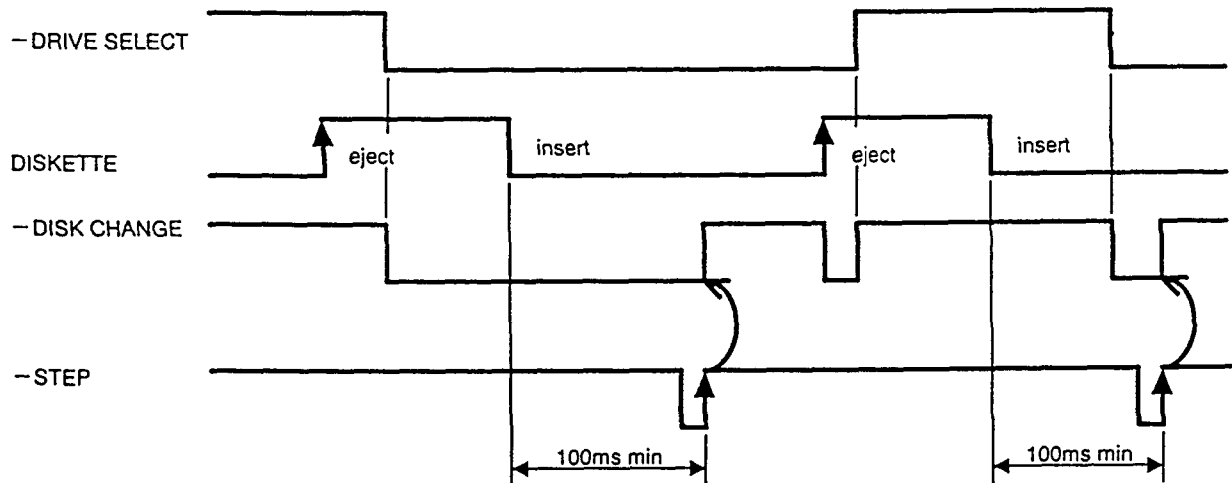
FIGURE 2-13   DISK CHANGE TIMING

2.5 POWER INTERFACE

The JU-257A6P requires only DC power for operation. DC power to the drive is provided via J2 located on the component side of the PCB. The single DC voltages, their specifications and their J2 pin designations are outlined in Table 2-1. The specifications outlined on current requirements are for one drive. For multiple drive systems, the current requirements are a multiple of the maximum current times the number of drives in the system.

TABLE 2-1   DC POWER REQUIREMENTS

J2 PIN	DC VOLTAGE	TOLERANCE	CURRENT	MAX RIPPLE (p to p)
1	+5 VDC	±0.5 VDC	0.9A max	100 mV MAX ALLOWABLE at the power connector of the PCB
2	+5V RETURN			
3	+5V RETURN			
4	N.C.			

2.5.1 POWER SEQUENCING

Applying DC power to the JU-257A6P can be done in any sequence. However, during power up, the −WRITE GATE line must be held inactive or at a high level.

2.6 FRAME GROUND AND SIGNAL GROUND

There is a 0 Ω Resistor between the aluminum base plate of the drive (= frame ground) and the signal ground of the control PCB.
The aluminum base plate of the drive is the same electrical level as the signal ground of the control PCB.

2.7   SEQUENCE OF EVENTS

The timing diagram shows the necessary sequence of events with associated timing requirements for proper position.
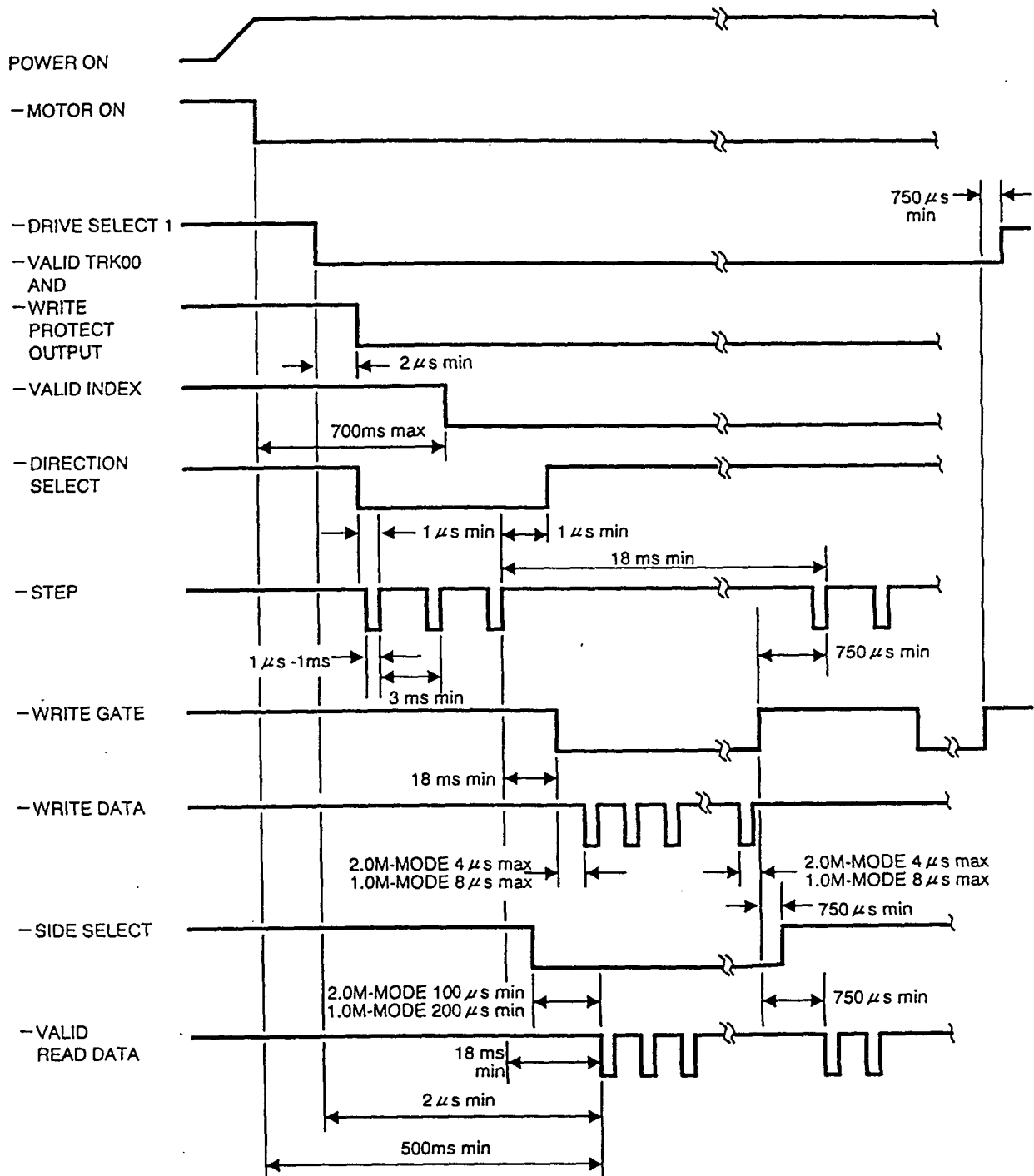
FIGURE 2-14   GENERAL CONTROL AND DATA TIMING REQUIREMENT

SECTION III
ELECTRICAL CONNECTIONS

3.1   INTRODUCTION

The electrical interface between the JU-257A6P and the host system is via two connectors. The first connector, J1, provides the signal interface and the second connector, J2, provides the DC power.

This section describes the physical connectors used on the drive and the recommended connectors to be used with them. See figure 3-1 for connector locations.
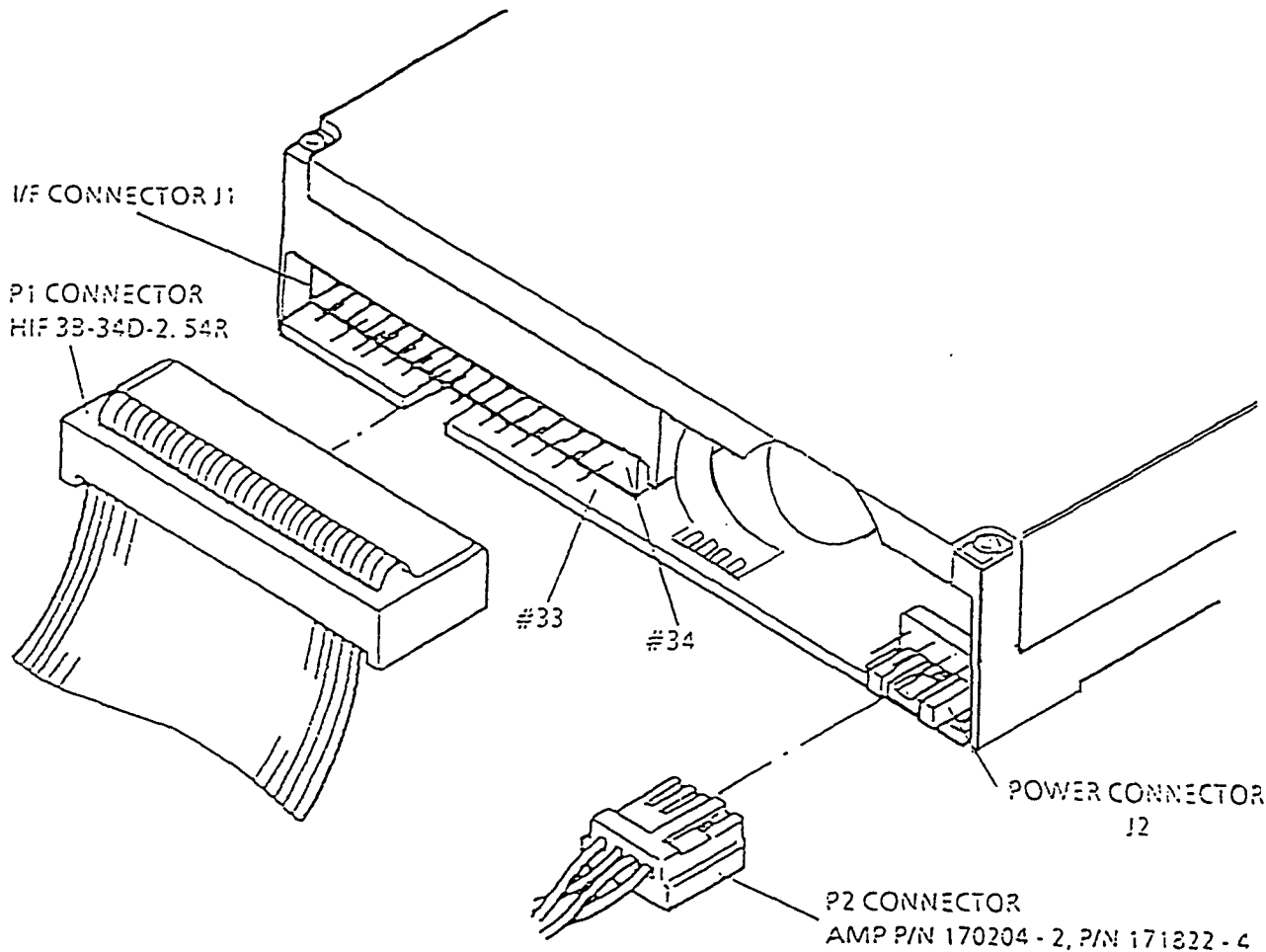
FIGURE 3-1   INTERFACE CONNECTORS LOCATIONS

3.2   J1 / P1 CONNECTOR (I/F CONNECTOR)

Connection to J1 is through a PCB pin type connector. Pins are numbered 1 through 34 with the odd-numbered pins being the PCB side in a row. The recommended connectors for J1/P1 are shown in table 3-1.

TABLE 3-1   RECOMMENDED P1 CONNECTORS

P1 (HOST)	MANUFACTURER
HIF 3B-34D-2.54R	HIROSE
IMSA-9000S-34-G	IRISO

3.3   J2 / P2 CONNECTOR (POWER CONNECTOR)

The DC power connector, J2, is mounted on the component side of the PCB and is located the right side of the stepper motor. J2 is a 4-pin TOKYO MICRO DEVICE Power connector P/N FJC01701B4. The recommended matching connector (P2) is AMP P/N 171822-4 utilizing AMP pins P/N 170204-2.

J2 CONNECTOR PIN

1	+5VDC
2	+5V RETURN
3	+5V RETURN
4	N.C.

J1 SIGNAL CONNECTOR

POWER SUPPLY
J2 CONNECTOR
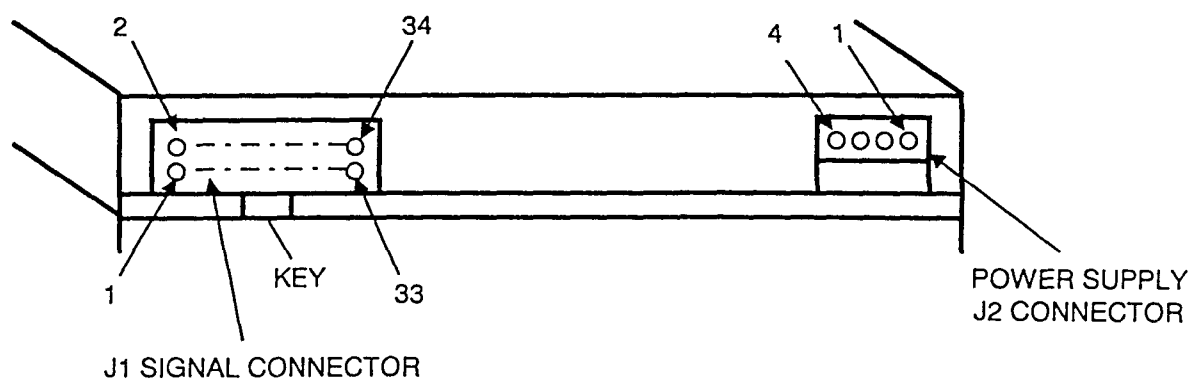
⚠ WARNING

Supply only DC power 5.0V±10% for pin #1 and pin #2 & #3 serve as ground of the power connector (J2). Any adding or alteration of power source might damage the disk drive or diskette.
Disassembly, modification and repair of the flexible disk drive are strictly prohibited.

SECTION IV
DRIVE MOUNTING AND DIMENSIONS

4.1   GENERAL

The section contains the mechanical dimensions and mounting recommendations for the JU-257A6P.

4.2   MOUNTING

NOTE

DO NOT MOUNT HORIZONTALLY WITH PCB ON THE UPPER SIDE.
DO NOT MOUNT VERTICALLY WITH FRONT BEZEL FACING UP/DOWN.

The drive can be mounted in either of the following positions (see Figure 4-1).

Front Loading - mounted vertically with Push Button in either lower left or upper right positions.
                   - mounted horizontally with PCB on the lower side.

HORIZONTAL   VERTICAL
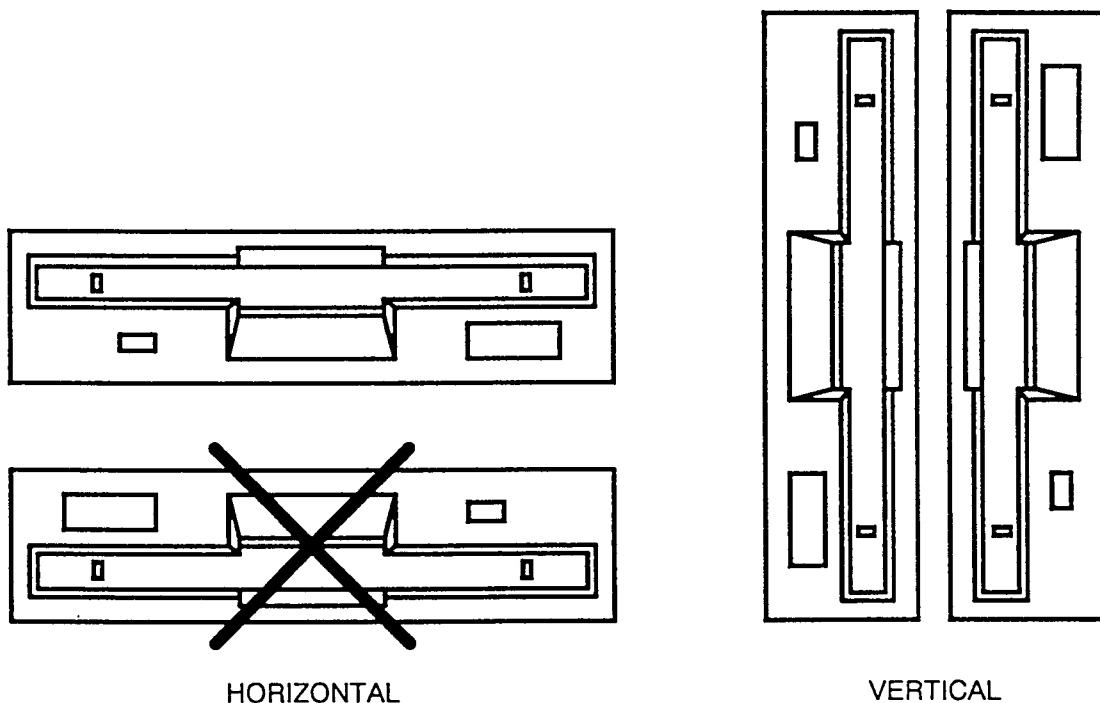
Rear side mounting holes are off-center of gravity. When you use these mounting holes, support the upper and bottom side of the FDD.

support

rear side mounting holes
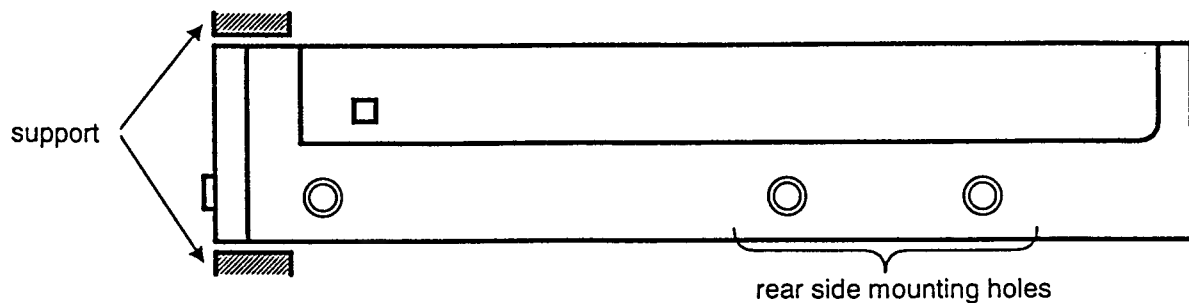
FIGURE 4-1   RECOMMENDED MOUNTING POSITIONS

4-1

4.3   OUR RECOMMENDATION OF SCREW AND FIXING CONDITION

a.   Recommendation of screw

   Type   :   M3 Pitch 0.5mm
   Length :   Insert length ℓ=3mm MIN. 5.5mm MAX

System Bracket
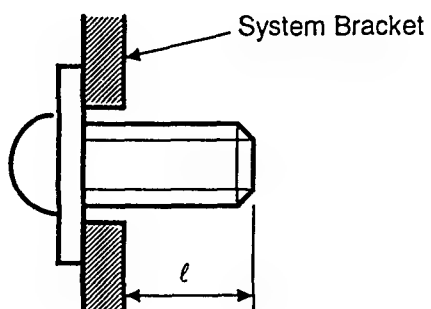
b.   Recommendation of fixing torque

   3.5kgfcm to 4.0kgfcm

c.   Recommendation of torque driver's rotation speed.

   1000rpm MAX.

4.4　MECANICAL DIMENSIONS
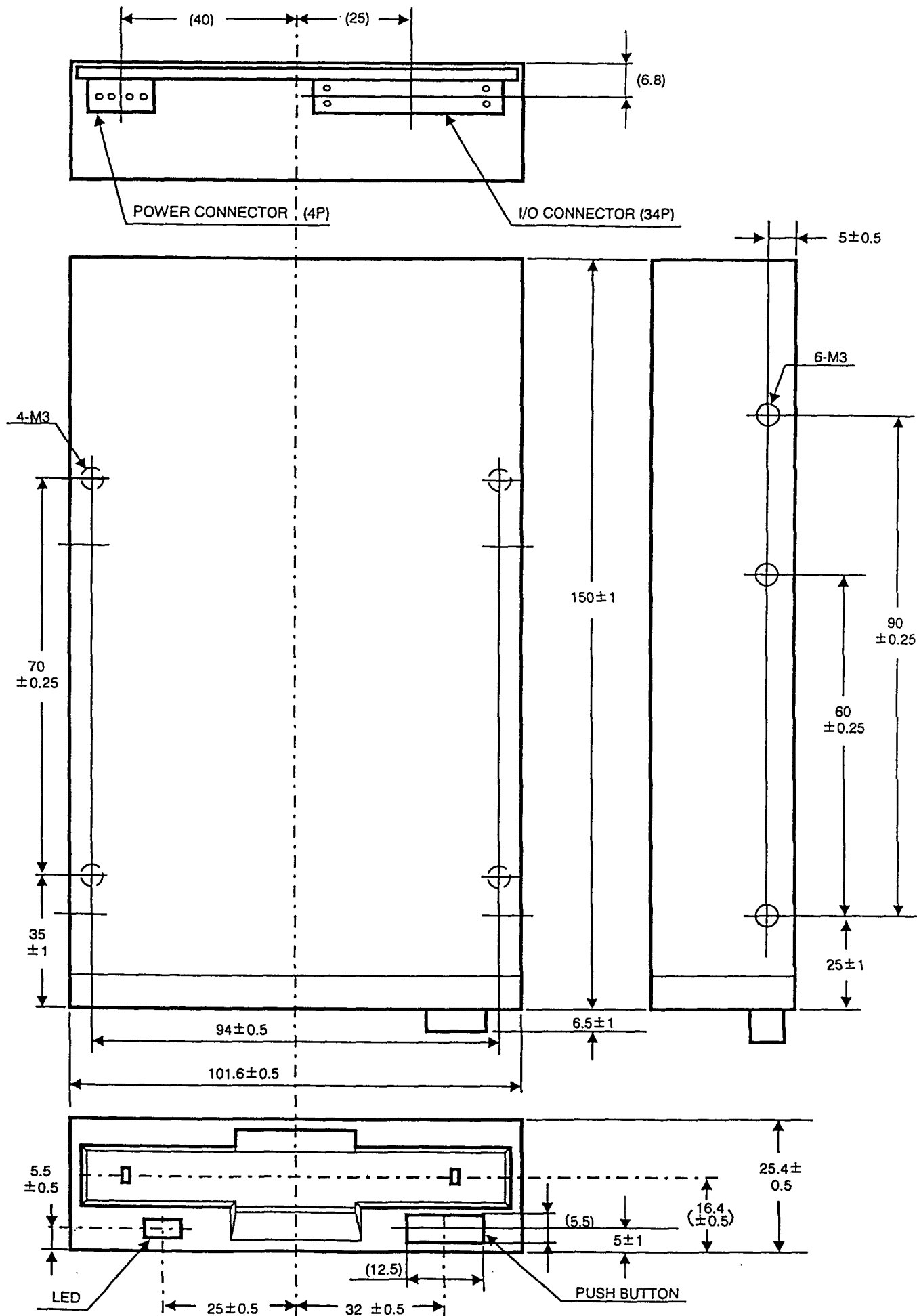
FIGURE 4-2　MECHANICAL DIMENSIONS

4-3

SECTION V
ERROR RECOVERY

5.1 WRITE ERROR

If an error occurs during a write operation, this error will be detected on the next revolution by doing a read operation (commonly called a "write check"). To correct the error, another write and write check operation must be done. If the write operation is not successful after 10 attempts have been made, a read operation should be attempted on another track. This is done to determine if the diskette or the drive is failing. If the error still persists, the diskette should be considered defective and discarded.

5.2 READ ERROR

Most errors that occur will be "soft" errors. Soft errors are usually caused by the following:

   a. Airborne contaminants passing between the read/write head and the disk. The contaminant will generally be removed by the diskette self-cleaning wiper

   b. Random electrical noise which usually lasts for a few microseconds

   c. Small defects in the written data and/or track not detected during the write operation which may cause a soft error during a read

The following procedure is recommended to recover from errors:

   a. Reread the track 10 times or until such time as the data is recovered

   b. If data is not recovered after using step "a", access the head to the adjacent track in the same direction previously moved. Return to the desired track

   c. Repeat step "a"

   d. If data is not recovered, the error is not recoverable

5.3 SEEK ERROR

Seek errors are detected by reading the ID field after the seek is completed. The ID field contains the track address. If a seek error is detected, the host system should issue a recalibrate operation (step out until the —TRACK 00 line goes active) and seek back to the original track.

SECTION VI
RECORDING FORMAT

6.1   GENERAL

The format of the data recorded on the disk is totally a function of the host system. Data can be recorded on the disk using FM or MFM encoding. In these encoding techniques, clock bits are written at the start of their respective bit cells and data bits at the centers of their bit cells.

Byte

A byte, when referring to serial data (being written onto or read from the disk drive), is defined as eight consecutive bit cells. The most significant bit cell is defined as bit cell 0 and the least significant bit cell is defined as bit cell 7. When reference is made to a specific data bit (i.e., ... data bit 3), it is with respect to the corresponding bit cell (bit cell 3).

During a write operation, bit cell 0 of each byte is transferred to the disk drive first with bit cell 7 being transferred last. Correspondingly, the most significant byte of data is transferred to the disk first and the least significant byte is transferred last.

When data is being read back from the drive, bit cell 0 of each byte will be transferred first with bit cell 7 last. As with reading, the most significant byte will be transferred first from the drive to the user.

Figure 6-1 illustrates the relationship of the bits within a byte and figure 6-2 illustrates the relationship of the bytes for read and write data.

FIGURE 6-1   BYTE (FM ENCODING)

BIT CELL 0 OF BYTE 0 IS FIRST DATA TO BE SENT TO THE DRIVE WHEN WRITING AND FROM THE DRIVE WHEN READING.

BIT CELL 7 OF BYTE 17 IS LAST DATA TO BE SENT TO THE DRIVE WHEN WRITING AND FROM THE DRIVE WHEN READING.
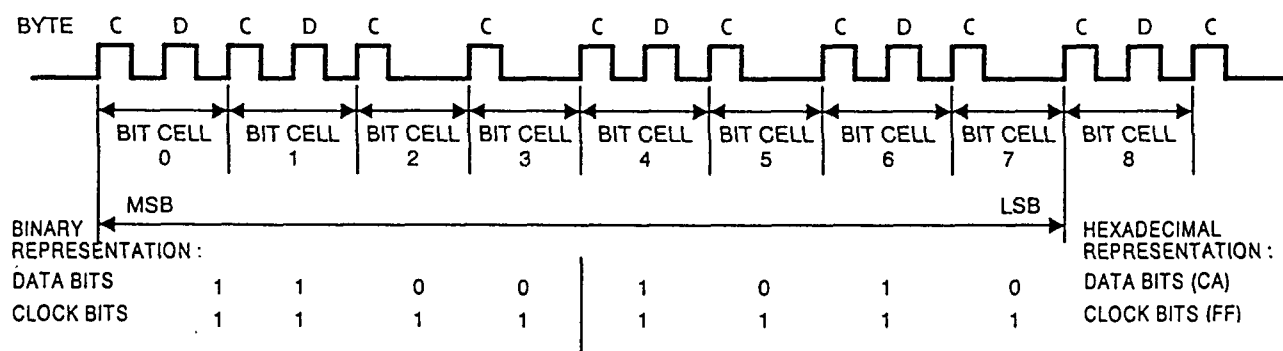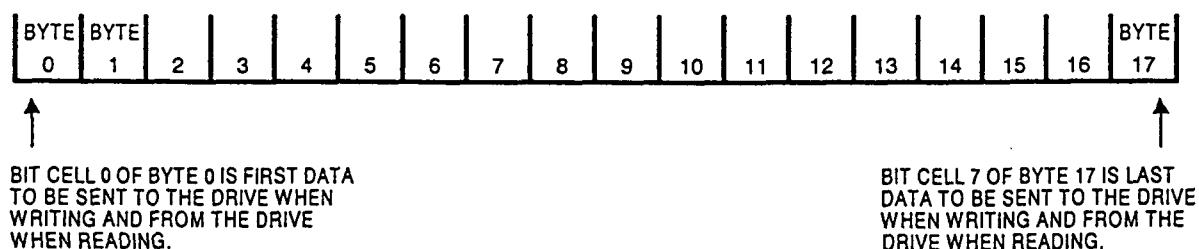
FIGURE 6-2   DATA BYTES

6.2   JU-257A6P SOFT SECTORS RECORDING FORMAT

In this format, the user system may record one long record or several smaller records. Each track is started by a physical index pulse and then each record is preceded by a unique recorded identifier. This type of recording is called soft sectoring.

The fields of Figure 6-3, in recording order (Gap 3 → Gap 4 → Gap 0 → Sync → Index Mark → Gap 1 → Sync → AM1 (ID Address Mark) → ID → CRC → Gap 2 → Sync → AM2 (Data or Deleted Data Mark) → Data → CRC → Gap 3 → Sync → Gap 4), carry the following values:

Field	Single density (FM) bytes (dec)	FM Data (Hex.)	Double density (MFM) bytes (dec)	MFM Data (Hex.)
Gap 3	40	FF	80	4E
Gap 4	6	00	12	00
Gap 0	1	FC*	3	C2*
(index mark)			1	FC
Sync / Gap 1	26	FF	50	4E
Sync	6	00	12	00
AM1 (sync)			3	A1*
AM1	1	FE*	1	FE
ID	4	*2	4	*2
CRC	2	*3	2	*3
Gap 2	11	FF	22	4E
Sync	6	00	12	00
AM2 (sync)			3	A1
AM2	1	FB* or F8*	1	FB* or F8*
Data	128 / 256 / 512	(Data)	256 / 512 / 1024	(Data)
CRC	2	*3	2	*3
Gap 3	27 / 42 / 58	FF	54 / 84 / 116	4E
Gap 4	44 / 73 / 37	FF	152 / 132 / 94	4E
Sector/Track	16 / 9 / 5		16 / 9 / 5	

*   These data bytes include missing clock.
*2   ID Field.
*3   CRC Check byte : $G(X)=1+X^5+X^{12}+X^{16}$

FIGURE 6-3   IBM TYPE FORMAT (1.0M-MODE)

		Gap 3	Gap 4	Gap 0	Sync		Gap 1	Sync	AM1	ID	CRC	Gap 2	Sync	AM2	Data	CRC	Gap 3	Sync	Gap 4	
Single density (FM)	bytes (decimal)	40	6	1	26		6	1	4	2	11	6	1	128 256 512	2	27 42 58	161 219 147	32 18 10
	Data (Hex.)	FF	00	FC*	FF		00	FE*	*2	*3	FF	00	FB* or F8*	(Data)	*3	FF	FF	
Double density (MFM)	bytes (decimal)	80	12	3	1	50	12	3	1	4	2	22	12	3	1	256 512 1024	2	54 84 116	450 510 334	32 18 10
	Data (Hex.)	4E	00	C2*	FC	4E	00	A1*	FE	*2	*3	4E	00	A1	FB* or F8*	(Data)	*3	4E	4E	

*   These data   bytes include missing clock.

*2.   ID Field.

*3   CRC Check byte : $G(X)=1+X^5+X^{12}+X^{16}$

FIGURE 6-4   IBM TYPE FORMAT (2.0M-MODE)

SECTION VII
OPERATION PROCEDURES

7.1   INTRODUCTION

The JU-257A6P is designed for ease of operator use to facilitate a wide range of operator-oriented applications. The following paragraphs provide a guide for handling procedures on the diskette and the flexible disk drive.

7.2   DISKETTE LOADING

To load the diskette, insert the diskette auto-shutter first, with the label facing up or opposite the eject button in HORIZONTAL mounting applications. Push in the diskette. A mechanical interlock ensures proper diskette insertion.

If the diskette fails to load, press the eject button, then reinsert the diskette.

To remove the diskette, push the eject button. The diskette will automatically eject.

7.3   DISKETTE HANDLING

To protect the diskette, the same care / handling procedures specified for computer magnetic tape apply. These precautionary measures are as follows:

   a.   Diskette not intended for immediate use should be stored in the box.

   b.   Keep diskette away from magnetic fields and from ferromagnetic materials which might become magnetized. Strong magnetic fields can distort recorded data on the disk.

   c.   Place ID labels in correct location, never use in reverse.

   d.   Do not use erasers.

   f.   Heat and contamination from carelessly dropped ash could damage diskette.

   e.   Do not expose diskette to heat or sunlight.
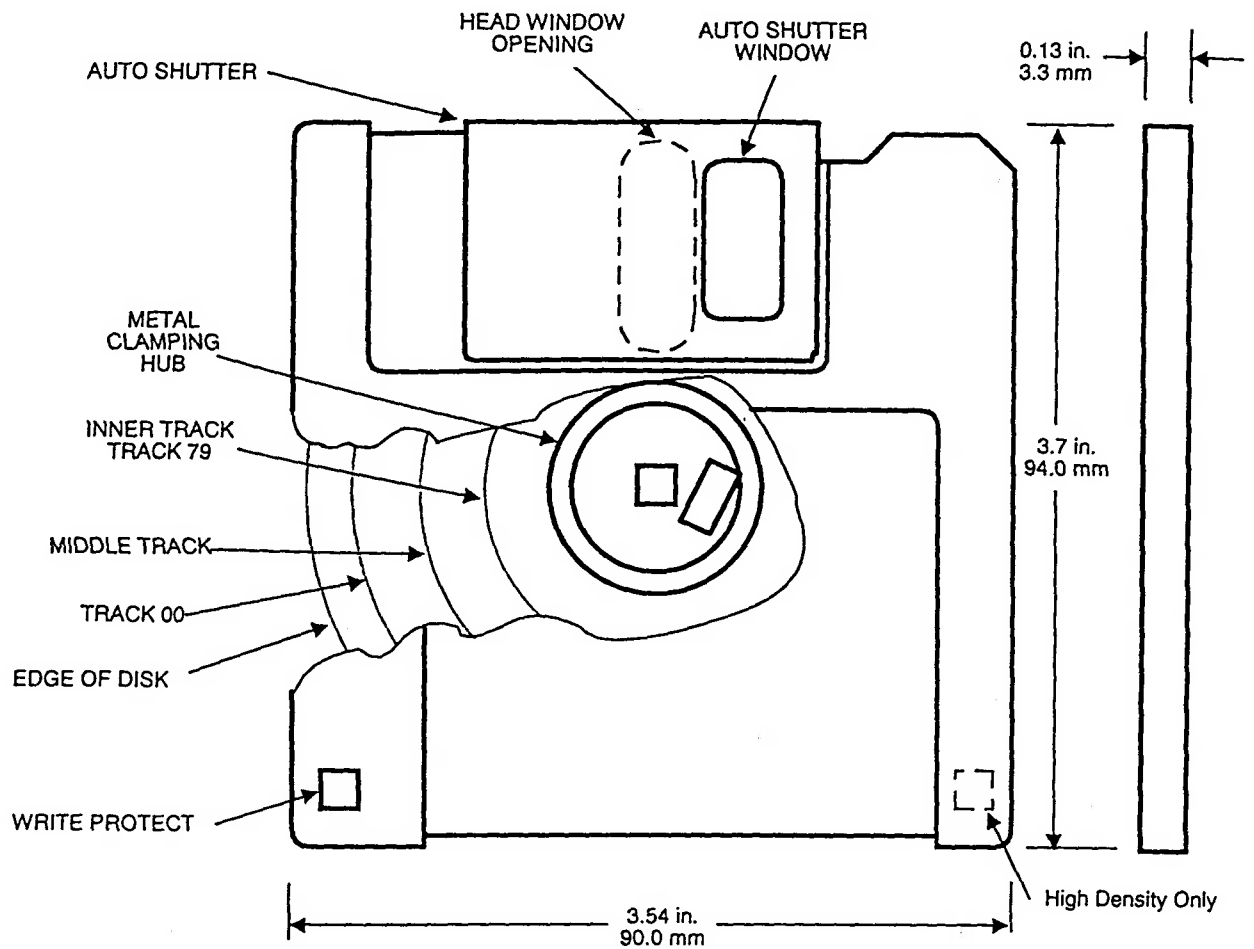
FIGURE 7-1   DISKETTE NOMENCLATURE

7.4   WRITE PROTECT FEATURE

The diskette comes with a mechanical write protect tab. To be a write protected diskette, slide the mechanical tab as shown in Figure 7-2 to uncover the write protect hole.

WRITE ENABLED
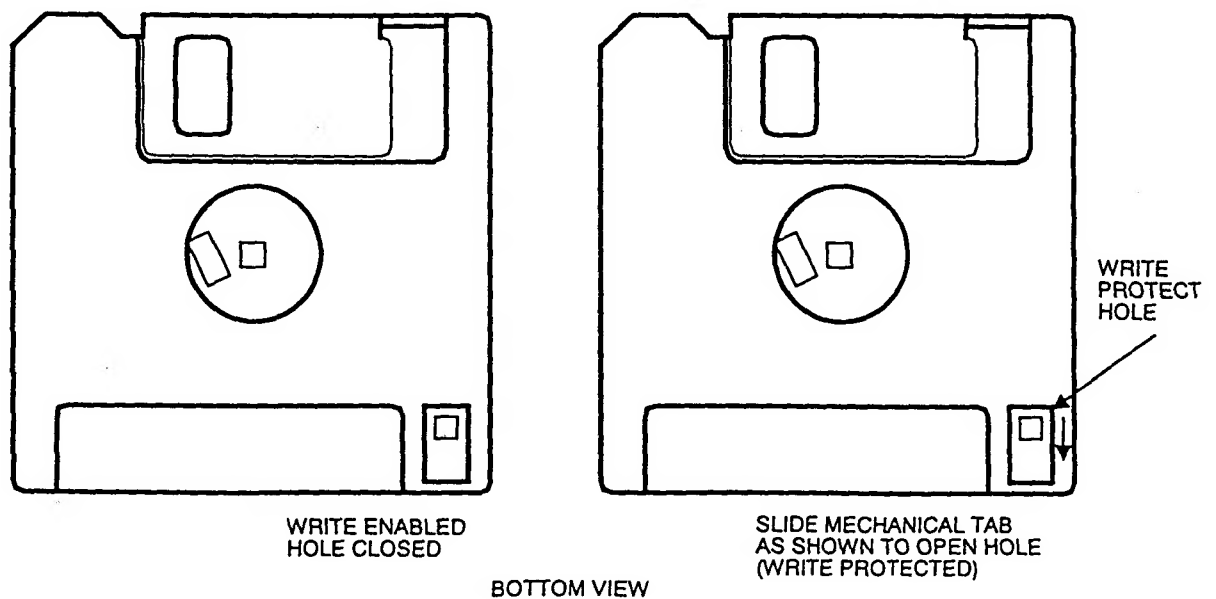HOLE CLOSED

SLIDE MECHANICAL TAB
AS SHOWN TO OPEN HOLE
(WRITE PROTECTED)

BOTTOM VIEW

FIGURE 7-2   WRITE PROTECT OPERATION